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Fiscal regimes in the EU

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FISCAL REGIMES IN THE EU

António Afonso and Priscilla Toffano

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Abstract

We assess the existence of fiscal regime shifts in the U.K., Germany, and Italy, using Markov switching fiscal rules. On the basis of a newly built quarterly data set, our results show the existence of fiscal regimes shifts, sometimes coupled with regime switches also regarding monetary developments. While in the UK "active" and "passive" (Leeper, 1991) fiscal regimes are somewhat clearer cut, in Germany fiscal regimes have been overall less active, supporting more fiscal sustainability. For Italy, a more passive fiscal behaviour is uncovered in the run-up to EMU.

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Keywords: Fiscal regimes, Markov-switiching, EU.

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Non-technical summary

The recent European fiscal crisis has revived interest in the topic of fiscal sustainability and the constraints fiscal policy can pose for monetary policy in the EU countries. In particular, both newspapers and academia have asked whether the recent surge of sovereign debt in response to the financial crisis can pose problems of sustainability for certain European countries and if that is threatening the standard conduct of monetary policy in the eurozone.

Fiscal rules have been mentioned in the policy and academic debate too. Part of these rules, as golden rules, balanced budget rules or deficit and debt targets, are mainly of practical use. Others focus on the cyclical sensitivity of fiscal policy or on its political determinants. All these rules maintain an ad hoc flavour because they are not derived as optimal rules and it is difficult to use them in a normative sense.

The purpose of this paper is to bring together different branches of the literature and to estimate fiscal reaction functions that can be derived as optimal rules, coupling them with monetary reaction functions. In addition, we allow for a regime switch in the parameters of these specifications to account for the non-linearity of fiscal policy and its shift in relation to different political preferences. By using a country-based perspective, instead of a panel analysis, we account for the differences in the fiscal policy of different countries. To this aim, we use a new fiscal quarterly data set, for the U.K., Germany, and Italy, respectively for the periods, 1970:4-2010:4, 1979:4-2010:3, and 1983:3-2010:4. Therefore, we estimate fiscal regime shifts and we try to avoid the ad-hoc character of many existing fiscal rules, by using fiscal rules that stem from the possibility of fiscal sustainability, which are then estimated within a Markov switching framework.

Our main results show the existence of fiscal regimes shifts, sometimes coupled with regime switches also regarding monetary developments. Following the terminology of Leeper (1991), we label as "passive" fiscal regimes where the fiscal authority is in charge of stabilizing the intertemporal budget constraint (i.e. reacts to increasing debt levels by generating higher expected primary surpluses), and as "active" fiscal regimes where the monetary authority is in charge of stabilizing the constraint (i.e. reacts to increasing debt levels by generating higher price levels) whereas the fiscal authority does not show any debt stabilizing motive.

In our analysis, in the U.K., "active" and "passive" fiscal regimes are clearer cut, notably regarding the periods 1992-1996 and after 2007, when fiscal policy tended to be more active. In Germany fiscal regimes have been overall more passive, providing some confirmation and support of more sustainable fiscal developments in this country throughout the sample period (1979:4-2010:3). Finally, for the case of Italy, a more passive fiscal behaviour can only be uncovered in the run-up to EMU, and broadly covering the period 1990-2000. In addition, a less active monetary regime, starting around 1999, is accompanied by the implementation, after 2000, of a more active behaviour in terms of fiscal developments.

1. Introduction

The recent European fiscal crisis has revived interest in the topic of fiscal sustainability and the constraints fiscal policy can pose for monetary policy in the EU countries. In particular, both newspapers and academia have asked whether the recent surge of sovereign debt in response to the financial crisis can pose problems of sustainability for certain European countries and if that is threatening the standard conduct of monetary policy in the eurozone. In this sense, after the seminal work of Leeper (1991), a holistic vision of monetary and fiscal policies is becoming popular in economics and it is difficult to hear considerations on fiscal policy that are not accompanied by a discussion of the monetary stance.

With this respect, monetary policy is normally synthetized by a Taylor rule (Taylor, 1993), which has proved to be interesting for describing the conduct of central banks on an empirical basis and has been derived as an optimal condition from micro-founded macro models (Clarida et al., 2000). On the other hand, fiscal policy is something much more complex to capture parsimoniously (see Auerbach, 2008) but fiscal rules have been mentioned in the policy and academic debate too. Part of these rules, as golden rules, balanced budget rules or deficit and debt targets, are mainly of practical use. Others focus on the cyclical sensitivity of fiscal policy or on its political determinants. All these rules maintain an ad hoc flavour because they are not derived as optimal rules and it is difficult to use them in a normative sense.

Fiscal reaction functions similar to the monetary ones have also been developed (Taylor, 2000) and Bohn (1998, 2005) provides important conditions for the sustainability of public finances based on them. These fiscal reaction functions have been extensively tested (Ballabriga and Martinez-Mongay (2005), Mendoza and Ostry (2007) and Afonso (2008) among others) within the sustainability literature and mainly in panel analysis. The interaction with the monetary stance has been typically disregarded in this part of the literature.

Benigno and Woodford (2003) and Schmitt-Grohe and Uribe (2007) have derived optimal fiscal rules in a DSGE and RBC setting. In this framework, the existence of changes in fiscal regime has not been taken into consideration. Nonetheless, the hypothesis of a shift in regime may be difficult to dismiss for fiscal policy, given the influence that political preferences changing over time have on it.

The aim of this paper is to bring together these different branches of the literature and to estimate fiscal reaction functions that can be derived as optimal rules, coupling them

with monetary reaction functions. In addition, we allow for a regime switch in the parameters of these specifications to account for the non-linearity of fiscal policy and its shift in relation to different political preferences. By using a country-based perspective, instead of a panel analysis, we account for the differences in the fiscal policy of different countries, as highlighted by Auerbach (2008) and Favero et al. (2011). To this aim, we use a newly built fiscal quarterly data set, for the U.K., Germany, and Italy, respectively for the periods, 1970:4-2010:4, 1979:4-2010:3, and 1983:3-2010:4.

Our main results show the existence of fiscal regimes shifts, sometimes coupled with regime switches also regarding monetary developments. While in the U.K. "active" and "passive" (in the sense of Leeper, 1991) fiscal regimes are clearer cut, in Germany fiscal regimes have been overall less active, supporting more fiscal sustainability. For Italy, a more passive fiscal behaviour is uncovered in the run-up to the Economic and Monetary Union (EMU).

The remainder of the paper is organised as follows. Section two briefly reviews the related literature. Section three presents the analytical framework. Section four reports and discusses the empirical analysis. Section five concludes.

2. Related literature

A conceptual distinction has been made, notably by Sims (1994), between a fiscal policy that stabilises government debt, and another one that does not. The former is usually also labelled as a "passive" (Ricardian) fiscal policy and the latter as an "active" (non-Ricardian) fiscal policy (Leeper, 1991). In the first case, future fiscal revenues are expected to pay for current outstanding government liabilities, and the fiscal authorities will adjust their behaviour accordingly. In other words, primary budget balances are expected to react to government debt, in order to ensure fiscal solvency.

In this context, there is also a quite extensive empirical literature estimating fiscal policy reaction functions, notably in cross-country panel analysis setup. These fiscal reaction functions essentially follow the idea that, if the fiscal authorities are motivated by debt stabilization and fiscal sustainability motives, a fiscal policy rule where the primary balance reacts (improves) to the debt (increases) would make sense. Additionally, and to account for the effects of the business cycle, the output gap also features as an explanatory variable in the estimated fiscal policy reaction functions.

For instance, Ballabriga and Martinez-Mongay (2005) find that for an EU panel the primary surplus reacts positively to government debt. In addition, Afonso (2008), for an

EU panel, supports the passive fiscal regime hypothesis, and a counter-cyclical response of fiscal policy given the positive effects on the primary balance of increases in the output gap, while Golinelli and Momigliano (2008) provide an interesting overview regarding alternative specifications of fiscal policy reaction functions.

On the other hand, another related approach consists in the estimation of Markov regime switches. This methodology has been followed notably for the US, for fiscal developments, but it has been used also to estimate monetary regime switches, in the context of Taylor-type monetary policy rules.[1] In a nutshell, such procedure allows for the endogenous estimation of (fiscal or monetary) policy regime changes, which can occur over time, and our paper will follow a similar approach.[2]

Within the application of Markov switching regimes to fiscal policy, two sub-strands of fiscal policy rules have been broadly used. First, a fiscal policy rule that is set up for the value of the primary budget deficit that allows the stabilisation of the debt ratio. Second, the estimation of fiscal rules either for government revenues or for government spending, allowing, for instance, that government revenue reacts to government spending, to government debt, and to the output gap. These approaches use the fiscal variables as ratios of GDP.

In the first sub-strand, Favero and Monacelli (2005) use the so-called debt stabilising primary budget deficit, a measure easily derived from the government budget constraint, to estimate a Markov fiscal regime switch for the US. With a quarterly data sample for the period 1960-2002 they report that fiscal policy was active from the 1960s throughout the 1980s, switching gradually to passive in the early 1990s, and returning to active in early 2001.[3] In addition, they also conclude that the fiscal response to the output gap is important in passive regimes and not statistically significant in active regimes.

Still in the same vein, Dewachter and Toffano (2012) also estimate a fiscal policy rule for the US, with quarterly data for the period 1965:2-2010:1, and report that while fiscal policy has been predominantly passive over that period, there are switches towards an active fiscal policy regime, specifically in the periods of 1974-1975, 2001-2005, and

[1] See, for instance, Assenmacher-Wesche (2006), with quarterly data, for the period 1973:1-2004:2 for the U.K. and the U.S. and for 1973:1-1998:4 for Germany. Castelnuovo et al. (2008) for the US, for the period 1955:Q1-2007:Q2, while Chen and MacDonald (2011) use such monetary regime switch in the context of a DSGE model for the UK.

[2] Hamilton (1989) and Engel and Hamilton (1990) initially used Markov switching modelling to study business-cycles.

[3] On the other hand, Ito, Watanabe, and Yabu (2007) find a passive fiscal behaviour for the US during the period 1840-2005. They also assess the period 1885-2004 for Japan, and 1830-2003 for the U.K. Doi, et al. (2011) also study the case of Japan in a similar framework.

starting in mid 2008. In addition, fiscal policy has reacted in a counter-cyclical fashion vis-à-vis output gap developments.

Regarding European countries, less evidence has been provided so far. For instance, Claeys (2005) finds that there is significant debt stabilization in U.S., Italy and U.K. On the other hand, the absence of debt stabilisation in Germany is considered as puzzling and not in line with other related existing evidence. He also finds that fiscal policy is mostly a-cyclical, which suggests that discretionary fiscal interventions affect importantly the automatic stabilisation response. In addition, Claeys (2008) reports that for Sweden after the fiscal consolidation of 1995 and after the adoption of the set of fiscal rules, in the period 2000:4-2002:3, the government actively used fiscal policy.

Following a similar fiscal rule setup for the primary budget balance, Afonso, Claeys and Sousa (2011) have addressed the case of Portugal. Using quarterly data over the period 1978:1-2007:4, they estimated both primary budget deficit and government spending and revenue rules. They report some evidence for a fiscal regime shift in 1988, when an active and a-cyclical fiscal policy becomes only slightly more passive and pro-cyclical after 1988. However, this change is not very significant and fiscal policy continued to be unsustainable, a result in line with previous related analysis of public finances in Portugal.

The abovementioned rule for the value of the deficit that stabilises the debt ratio imposes, in practice, for such ratio to be unchanged in two consecutive periods. While this rule may have an appealing feature for the cases where the debt ratio tends to be in an upward path, it is probably less obvious whether it fits as well to a situation of more stable debt ratio developments. Such caveat may be behind the fact that some competing results are found in the literature.

In terms of the second sub-strand of fiscal rules, we can identify the Davig and Leeper (2005) type rules, which have been initially proposed for government revenue ratios. For instance, they estimate a Markov switching revenue rule for the US for the period 1948:2 to 2004:1 and report that a passive fiscal policy reacts strongly to government spending, while active fiscal policies' reactions are more mitigated. In both cases, revenues increase in a counter-cyclical fashion with the output gap, an effect attributed to the functioning of the automatic stabilisers. Still for the US, and for the period 1949:1 to 2008:4, Davig and Leeper (2011) additionally concluded for an active fiscal stance in the early to mid-1980s, and through the 2000s (related to the Bush tax cuts).[4]

[4] They also report an active monetary policy in the early to mid-1980s, a situation that is not sustainable ad infinitum.

Thams (2007) also used the Markov switching approach proposed by Davig and Leeper (2005) to assess fiscal regimes in Germany (1970:1-2003:4) and Spain (1986-2003). He reports a much stronger response of government revenue to government spending in Spain, while the relationship between government debt and revenue is weaker than in Germany.

3. Analytical framework

3.1. Derivation of optimal monetary and fiscal rules

To provide a structural underpinning to the reaction functions that we will estimate later on, we can draw on Kirsanova, Stehn and Vines (2006) who augment the standard New Keynesian setting (see Clarida, Gali and Gertler, 1999) to endogenise fiscal policy. Through this simple set up, it is possible to reflect on the interaction and substitutability between monetary and fiscal policies. In particular, the authors consider an IS curve that we can generalize similarly to Reade and Stehn (2008) in the following way:

$$\bar{y}_t = k^f E_t \bar{y}_{t+1} + k^b \bar{y}_{t-1} - \sigma[i_t - E_t\pi_{t+1}] + \phi b_t + \delta def_t + \varepsilon_t^y \qquad (1)$$

where $\bar{y}_t$ is the output gap, π_t the inflation rate, i_t the nominal interest rate, $[i_t - E_t\pi_{t+1}]$ the real interest rate, b_t the stock of government debt, def_t the primary (i.e. net of interest payments) deficit defined as spending minus receipts and considered as a fraction of GDP, and ε_t^y an i.i.d. distributed demand shock. E_t is the expectation operator and the superscripts *f* and *b* refer, respectively, to coefficients of forward looking and backward looking variables. According to the specification of the aggregate demand equation, the output depends negatively on the real interest rate and positively on lagged and expected output. If fiscal policy has real effects, then any increase in the deficit increases the aggregate demand both directly via the multiplier, δ, and indirectly, through the debt level, which in a non-Ricardian framework induces a wealth effect impacting on output.

The model includes then a Phillips curve describing inflation:

$$\pi_t = \chi_t^f \beta E_t \pi_{t+1} + \chi_t^b \pi_{t-1} + \omega_t^1 \bar{y}_t + \omega_t^2 \bar{y}_{t-1} + \varepsilon_t^\pi \qquad (2)$$

where the variables are defined as above, β is a discount rate comprised between 0 and 1 and ε_t^{π} is an i.i.d. distributed inflation shock. The aggregate supply equation depends positively on expected and lagged inflation, and on current and lagged output. Differently from the IS curve where both monetary and fiscal policy had a direct impact on the evolution of the output gap, neither monetary nor fiscal policy have such an impact for inflation. As observed in Kirsanova et al (2006), this implies that the two macro-policies are perfect substitutes in the management of output and inflation.

The description of the economy is completed with a debt accumulation equation:

$$\frac{b_t}{y_t} = (1+\rho_t)\frac{b_{t-1}}{y_{t-1}} + \frac{def_t}{y_t} \tag{3}$$

where y_t represents nominal GDP and ρ_t is the rate of return on government debt. This equation will be thoroughly discussed in section 3.2.

Equations (1)-(3) synthesize the dynamics of the economy where the policymakers intervene with macroeconomic instruments. In particular, after having observed the shocks in output and inflation, the policymakers use instruments for monetary and fiscal policy (T_j) to minimise the present discounted value of a social loss function (L_j) that we define as in Reade and Stehn (2008):

$$L_j = \min_{T_j} \frac{1}{2} E_{t-1} \sum_{s=t}^{\infty} \beta^{s-t} W_s \left[\pi_t, \bar{y}_t, \pi_{t-1}, \bar{y}_{t-1} \right] \tag{4}$$

with $j = m, f$ indicating monetary and fiscal policy, E_{t-1} expectations available in t-1 and β the discount rate for losses comprised between 0 and 1.

The loss function is generally specified in terms of the policymakers' stabilization objectives (see Woodford, 2003):

$$W_s = \left[\pi_s - \pi_s^*\right]^2 + \alpha \left[\bar{y}_s - \bar{y}_s^* \right]^2 \tag{5}$$

where we have in brackets the square of the difference of, respectively, inflation and output from their targets, and α is the weight attached by policymakers to output stabilization

relative to inflation stabilization. This specification captures the idea that inflation and output different from their targets represents a cost for the economy and are disliked by the policymakers.

Given the evolution of the economy according to (1)-(3), policymakers will optimize every period by minimizing the loss function defined in (4)-(5). Since the minimization problem is stated in linear-quadratic terms, the optimal rules can be expressed as linear functions (see Woodford 2003). In particular, the optimal rule for monetary policy will be a Taylor rule with optimised coefficient (ϕ) of the form used in Reade and Stehn (2008):

$$r_t = \phi_1^{\pi} E_t \pi_{t+1} + \phi_2^{\pi} \pi_t + \phi_3^{\pi} \pi_{t-1} + \phi_1^{y} E_t \bar{y}_{t+1} + \phi_2^{y} \bar{y}_t + \phi_3^{y} \bar{y}_{t-1}. \qquad (6)$$

Monetary policy is said to be "active" (Leeper, 1991) when $\phi_1^{\pi} + \phi_2^{\pi} + \phi_3^{\pi} > 1$, i.e. when nominal interest rates are raised on a more than one-for-one basis (real interest rates then rise when inflation rises) in order to weaken demand and counteract inflation; it is "passive" when $\phi_1^{\pi} + \phi_2^{\pi} + \phi_3^{\pi} < 1$. The response to output is expected to be positive too, because of the fact that output is considered a predictor of future inflation (Svensson, 1999).

The optimal fiscal rule will resemble:

$$def_t = \lambda \bar{b}_t + \beta_2 \bar{y}_t + \beta_3 \pi_t \qquad (7)$$

with optimised coefficients $\lambda, \beta_2, \beta_3$. From equation (7) it is possible to see that fiscal policy can play a role in the stabilization of output and inflation and, therefore, helping monetary policy.

From the discussion in Kirsanova et al (2006), we see how the determinacy of the system now does not only depend on the monetary response to inflation but also on the fiscal response to debt. If the fiscal reaction to the debt dynamics is strong enough (i.e. λ is positive and greater than the real interest rate), monetary policy will follow a conventional Taylor rule, whereas if fiscal policy does not sufficiently react to the debt dynamics (i.e. λ is smaller than the real interest rate or negative), monetary policy will have to step in and lower interest rates in response to an inflation shock for stabilizing the government's debt. In this latter case, fiscal policy is said to be "active" in the words of Leeper (1991).

3.2. Fiscal sustainability à la Bohn

The key equation for evaluating the sustainability of fiscal policy, equation (8) below, is derived from the nominal government budget constraint (GBC) which links the single-period government's financing (right-hand side) and expenditures (left-hand side) as following:

$$P_t G_t + (1 + R_t) B_{t-1} = B_t + P_t T_t \,. \tag{8}$$

In equation (8), P is the price level, G is the real primary government expenditure, T are total real revenues, B is the nominal value of government bonds, R is the interest rate on bonds and RB are the interest payments. The subscript t refers to the time dimension.

Dividing equation (8) by the price level, P_t, and by real GDP, y_t, allows us to express the GBC in real terms and as a ratio to GDP:

$$\frac{G_t}{y_t} + \frac{1 + R_t}{(1+\pi_t)(1+\gamma_t)} \frac{b_{t-1}}{y_{t-1}} = \frac{b_t}{y_t} + \frac{T_t}{y_t} \,, \tag{9}$$

with $b = \frac{B}{P}$, $\pi_t = \frac{P_t - P_{t-1}}{P_{t-1}}$ represents the rate of inflation, and $\gamma_t = \frac{y_t - y_{t-1}}{y_{t-1}}$ is the rate growth of real GDP.

From the GBC, we can also define the total nominal government deficit, $P_t D_t$, as the difference between expenditures and revenues or, analogously, as the change in public debt:

$$P_t D_t = P_t G_t + R_t B_{t-1} - P_t T_t = B_t - B_{t-1} \,. \tag{10}$$

As above, we can derive the real budget deficit in proportion of GDP, which corresponds to equation (10):

$$\frac{d_t}{y_t} = \frac{G_t}{y_t} + \frac{R_t}{(1+\pi_t)(1+\gamma_t)} \frac{b_{t-1}}{y_{t-1}} - \frac{T_t}{y_t} = \frac{b_t}{y_t} - \frac{1}{(1+\pi_t)(1+\gamma_t)} \frac{b_{t-1}}{y_{t-1}} \tag{11}$$

with $d_t = \frac{D_t}{P_t}$.

The total budget deficit less the interest payments denotes the nominal primary budget deficit, which is the budget balance variable we use in this paper:

$$P_t DEF_t = P_t D_t - R_t B_{t-1} \,, \tag{12}$$

implying, using equation (11), that the real primary budget deficit-to-GDP ratio is given by:

$$\frac{def_t}{y_t} = \frac{G_t}{y_t} - \frac{T_t}{y_t} \tag{13}$$

and this deficit needs to be financed by additional issuance of government debt, which, from rearranging (9) gives:

$$\frac{def_t}{y_t} = \frac{b_t}{y_t} - \frac{(1+R_t)}{(1+\pi_t)(1+\gamma_t)} \frac{b_{t-1}}{y_{t-1}} \,, \tag{14}$$

where $def_t = \frac{DEF_t}{P_t}$.

Letting $1+\rho_t = \frac{1+R_t}{(1+\pi_t)(1+\gamma_t)}$, we can rewrite equation (14) as follows:

$$\frac{b_t}{y_t} = (1+\rho_t)\frac{b_{t-1}}{y_{t-1}} + \frac{def_t}{y_t} \,. \tag{15}$$

Equation (15) is a non-linear difference equation in $\frac{b_t}{y_t}$ describing the dynamics of public debt. These dynamics are influenced by the rate of return on government debt, ρ_t, and by fiscal policy decisions on taxing and spending synthesized in the budget deficit

variable, def_t. In particular, if $\rho < 0$ equation (15) is a stable difference equation, whereas if $\rho > 0$ it is an unstable difference equation (see notably Polito and Wickens, 2005, for a detailed analysis of equation (15)).

Concentrating on the stable case, we can derive the paths of public debt as implied by the sequences of interest payments and primary deficits:

$$\frac{b_{t+n}}{y_{t+n}} = \left(\prod_{k=0}^{n}(1+\rho_{t+k})\right)\frac{b_{t-1}}{y_{t-1}} + \sum_{j=0}^{n}\left(\prod_{k=j+1}^{n}(1+\rho_{t+k})\right)\frac{def_{t+j}}{y_{t+j}} \quad . \tag{16}$$

Through fixing the value for ρ_t to ρ and taking conditional expectations, we solve backwards to obtain:

$$E_t\left(\frac{b_{t+n}}{y_{t+n}}\right) = (1+\rho)^n\left(\frac{b_t}{y_t}\right)^* + \sum_{j=0}^{n-1}(1+\rho)^{n-j}E_t\left(\frac{def_{t+j}}{y_{t+j}}\right), \tag{17}$$

with $\left(\frac{b_t}{y_t}\right)^* = (1+\rho_t)\frac{b_{t-1}}{y_{t-1}}$ indicating the debt at the start of period t.

Dividing by $(1+\rho)^n$, taking the limit as $n \to \infty$, and rearranging gives:

$$\left(\frac{b_t}{y_t}\right)^* = -\sum_{j=0}^{\infty}\frac{1}{(1+\rho)^j}E_t\left(\frac{def_{t+j}}{y_{t+j}}\right) + \lim_{n\to\infty}\frac{1}{(1+\rho)^n}E_t\left(\frac{b_{t+n}}{y_{t+n}}\right), \tag{18}$$

showing that the initial debt level is equal to the expected present value of current and future primary surpluses (the so-called Intertemporal Government Budget Constraint (IGBC)), if and only if the second term of equation (18), i.e. the discounted future debt, converges to zero (see Bohn, 2005). If the present and future primary surpluses to GDP ratios grow in a non explosive way, then the debt to GDP ratio will remain finite too.

Empirical work on sustainability has traditionally concentrated on understanding if fiscal data followed a trajectory consistent with (18) by observing unit root and co-integration relations (see, for instance, Hamilton and Flavin, 1986, Afonso, 2005) but such sustainability exercises rely on the assumption that the rate of return on debt is constant. However, this assumption can be problematic, as shown by Bohn (2005), and a fixed interest rate on public debt may be the right factor for discounting the flow of primary

balances in equation (18) only in very specific cases (see Mendoza and Ostry, 2007, for a thorough discussion of the issue).

A more general test for fiscal sustainability is proposed by Bohn (2005) and called "model-based" because of its derivation from a general equilibrium setting where "the agent's ability to borrow is constrained by other agents' willingness to lend". In this framework, the counterpart of IGBC in (18) is derived from the optimizing behaviour of the agents and is as follows:

$$\left(\frac{b_t}{y_t}\right)^* = -\sum_{n=0}^{\infty} E_t\left[u_{t,n} * \frac{def_{t+n}}{y_{t+n}}\right], \tag{19}$$

where u is the economy pricing kernel for contingent claims on period $t+n$ (see Bohn, 1995), which applies to all financial assets. Exactly as in (18), the IGBC states that the initial level of debt has to equal the current and future flows of primary balances, but allows for a covariance term between the pricing kernel and the surpluses that is assumed to be zero in (18) while it seems relevant in empirical studies (see Mendoza and Ostry, 2007).

Proposition 1 in Bohn (2005) presents an idea for a model based test related to equation (19). This test has the form of a linear feedback rule for primary budgetary balances of the type:

$$s_t = \lambda b_{t-1}^* + \mu_t \tag{20}$$

where $s_t = -\frac{def_t}{y_t}$ and $b_t^* = \left(\frac{b_t}{y_t}\right)^*$ in our notation, μ_t include other variables that can have an impact on the primary balance, and $\lambda > 0$ to ensure sustainability. The idea behind is that, when μ_t is bounded as a share of output, the present value of output is finite and markets of contingent claims are complete, any $\lambda > 0$ implies that $E_t\left[u_{t+n} * \frac{def_{t+n}}{y_{t+m}}\right] \approx (1-\lambda)^n b_t^* \to 0$ and μ_t is asymptotically irrelevant.

It is important to remember that, as discussed in Bohn (2005), a case where $\lambda > 0$ is sufficient to guarantee fiscal sustainability, but not necessary. In fact, we must not forget that the IGBC has to hold over an infinite horizon and then constitutes a weak criterion for fiscal solvency. So, if economic agents are still buying government bonds when $\lambda < 0$ and

we assume rationality, this would not necessarily equate to fiscal non-sustainability but it could be due to the fact that they expect a policy change in the future which can bring debt back to a sustainable path. Therefore, particular caution is required when reading the results of estimates coming from equations similar to (20) and when trying to extrapolate sustainability considerations for future policies based on the past ones.

3.3. Fiscal and monetary regimes

A joint perspective on monetary and fiscal policy is provided by the so-called Fiscal Theory of the Price Level (FTPL) (Leeper, 1991, Sims 1994, Buiter 2002, Woodford 1994, 2001). The FTPL argues that monetary and fiscal policies are perfect substitutes with respect to the objectives at which macro policies aim at, i.e. debt stabilization and price level determination. Normally, monetary policy is deemed to be in charge of the determination of the price level and fiscal policy ensures debt stabilization, but the other way round is also possible, and the FTPL helps in shedding light on a regime where fiscal policy controls inflation and monetary policy controls debt. The interaction between the two macro policies takes place via the IGBC, discussed in the previous section. Considering the IGBC in equation (18), the intuition provided by the FTPL is that, for any increase in the right-hand side variable of $b_t = \frac{B_t}{P_t}$, with everything else staying equal, either fiscal policy generates higher future primary surpluses ($-def_{t+j}$) or an increase in the price level (P_t) will reduce the real value of the government debt in order to restore the budget constraint.

Economically speaking, either monetary policy pins down the price level and then fiscal policy must generate higher future budget surpluses to satisfy the IGBC, or fiscal policy is not able to generate higher expected surpluses and then the price level increases due to a wealth effect experienced by the economic agents, thus restoring the IGBC. This wealth effect is generated by the expectations of the agents about the fact that the government will not offset the debt increase with tax increases in the future. As a consequence they feel wealthier and augment their consumption, which in turn generates a price increase to the point where the value of nominal assets equals the present value of the expected primary surpluses[5]. With this respect, there is little that even an independent

[5] Indeed, one characteristic of the FTPL is that it assumes nominal debt, whereas the unpleasant monetaristic arithmetic à la Sargent and Wallace (1981) reasons in terms of real debt. As noticed by Leeper and Walker (2011), this distinction is crucial to understand the mechanisms of the two theories, which are sometimes

central bank can do to anchor expectations and keep inflation under control. Therefore, in a nutshell, the price level could be determined by the IGBC.

The macroeconomic equilibrium that prevails is then determined by the regime which is in place with respect to the division of tasks between monetary and fiscal policy. At this point, one would like to test which kind of monetary-fiscal regime is working at a certain moment and section 3.2 could provide a guide in that respect. Indeed we have seen in equation (20) that $\lambda > 0$ is sufficient to guarantee fiscal sustainability and to ensure a fiscal policy which is "passive" as discussed in section 3.1. As we will see in the next section, many authors have tried to test the FTPL by estimating monetary and fiscal reaction functions according to these lines. The problem, as noted by Cochrane (1998) and Leeper and Walker (2011) among others, is that a monetary active/fiscal passive regime and a monetary passive/fiscal active regime use the same equations, i.e. a Fisher relation and the IGBC, to explain any given data set. This amounts to say that it is impossible to distinguish between regimes, as both of them can produce the same time series and, as highlighted in Canzoneri, Cumby and Diba (2011), there can be two explanations for any aspect of the data under analysis. The literature has then adopted a softer approach by trying to understand which explanation can be more plausible. Even with this, Cochrane (1998) proposes, for example, a monetary passive/fiscal active explanation for the US post-war period whereas Canzoneri, Cumby and Diba (2011b) promote a monetary active/fiscal passive explanation of the same period. At the same time, as explained in Leeper and Walker (2011), a possible solution to this identification problem could be to empirically specify policy rules. In fact, the observational equivalence described above is linked to the choice of the exogenous and unobservable driving processes, which are determined through the policy rules. The fact of making empirically justified assumptions on the exogenous processes through the policy rules should help soften this identification problem. This justifies our next section.

4. Empirical analysis

4.1. Markov Switching analysis

After having clarified the foundations of our simple policy reaction functions, we turn to the empirical estimation of the fiscal and monetary equations for three European

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confused. The mechanism of the FTPL is not about seigniorage but is related to how changes in the expected present value of primary surpluses and seigniorage lead to changes in the price level, whereas the unpleasant arithmetic is about how changes in debt induce increases in the expected seigniorage.

countries: U.K., Germany and Italy. The choice of the countries has been suggested by the availability of sufficiently long data series and, at the same time, by the relative economic and institutional characteristics of the countries. In this sense, we will present the results of two countries belonging to the euro area but with different historical fiscal positions (Germany and Italy) and the biggest European economy external to the EMU (the U.K.). This will allow us to draw some reflections on the fiscal and monetary stance of these countries, and to make some comparisons among them.

For the fiscal side, we find inspiration in Bohn (1998, 2005) to estimate a reaction function similar to the one discussed in the previous paragraph and defined as:

$$d_t = \lambda b^*_{t-1} + \mu_t + \varepsilon_t \tag{21}$$

where d_t represents the nominal primary deficit to GPD ratio, b^*_t the nominal debt to GDP ratio and ε_t a mean zero error term. Notice that, while in the theoretical section we derived the real expression of the GBC and lower case letters indicated real variables, here we use time series that are stated in nominal terms, as we find them in the data sources. The same reasoning clearly applies.

The μ_t component is specified as follows:

$$\mu_t = c + \beta_1 \bar{g}_t + \beta_2 \bar{y}_t + \beta_3 \pi_t$$

where c is a constant, $\bar{g}_t$ the expenditure gap defined as the temporary deviation from the trend level of government outlays, y_t is the output gap defined as the temporary deviation from the trend of output and π_t is inflation. The trend components necessary to derive the gaps are computed through the HP filter of log real expenditures and log real GDP respectively[6], whereas inflation is based on the CPI index and expressed in annual terms.

As discussed in Bohn (1998, 2005) and further in Mendoza and Ostry (2007) and Doi et al. (2011), the choice of the variables to be included in μ_t is guided by the optimal taxation theory (see Barro, 1986). In this light, the output gap accounts for the counter-cyclical motive of fiscal policy whereas the expenditure gap for temporary increases of government expenditure that do not necessarily compromise long run debt stabilization. In

[6] Positive values of the gaps refer to above trend expenditures or output. For quarterly data, the smoothing parameter has been set equal to 1600.

general, we would expect a negative coefficient for the output gap, β_2, to reflect the operation of the automatic stabilizers (when output is below trend, then the deficit is higher, and vice versa) and a positive coefficient for the expenditure gap, β_3 (when there are transitory increases in government expenditures, e.g. during wars, then the deficit increases, and vice versa, due to a tax smoothing behaviour of the government).

In addition to the variables considered by these authors, we include also inflation as suggested by the optimal rule derived in section 3.1. In addition, similarly to Claeys (2005), we want to test if inflation can be considered a target variable for fiscal policy too, and not only for monetary policy.

At the same time, we recognise that fiscal policy is highly influenced by political preferences and cyclical economic circumstances which may change over time. For this reason, instead of estimating equation (21) as it is, we allow for an endogenous switch of its parameters and estimate the following:

$$d_t = \lambda(S_t^F)b_{t-1}^* + (c(S_t^F) + \beta_1(S_t^F)\,\bar{g}_t + \beta_2(S_t^F)\,\bar{y}_t + \beta_3(S_t^F)\pi_t) + \sigma_t(S_t^F)\varepsilon_t \qquad (22)$$

where S_t^F identifies the fiscal policy regime which follows a first order Markov chain with transition matrix P^F, whose element is $p_{ij} = \Pr[s_t = i, s_{t-1} = j]$, and the other parameters, defined as above, are allowed to take on different values across different regimes.

The issue of switching in fiscal regimes is not new to the literature but has been modelled endogenously, via a Markov Switching (MS) approach, mainly within the framework of the FTPL. Considering that the IBC (see equation 18) is a condition which has to hold over time, empirical attempts to validate the FTPL have been based on understanding which authority is in charge of satisfying it. In particular, when there is an increase in the debt level, both the fiscal and the monetary authority can keep the equality in equation (18) via increases in surpluses (for the fiscal authority) or in prices (for the monetary authority). As we have seen, Leeper (1991) labels as "passive" the behaviour of the authority which is in charge of debt stabilization as opposed to the "active" behaviour of the authority which can be directed towards different objectives. In this sense, Davig and Leeper (2007), Favero and Monacelli (2005) and Dewachter and Toffano (2012) for the US, Thams (2007) for Germany and Spain, Afonso et al (2009) for Portugal, and Ito et

al (2007) for Japan, the US and UK estimated MS equations similar to (22) to understand when fiscal policy was behaving passively and when actively, as this entails different underlying rational expectations equilibrium (see, for instance, Leeper, 1991, Woodford, 1996, Behabib et al. 2001).

The common feature of the existing work is that their target variable for fiscal policy is not the lagged debt as modelled in (20), but the so called "debt-stabilizing deficit", i.e. the level of deficit which implies a zero growth of debt. But if it is true that the debt-stabilizing deficit accounts for important effects on debt of both interest and growth rates, it seems also to provide a particularly strong form of sustainability, implying a zero growth of debt, through which discriminating active and passive regimes. Moreover, there seems to be no strong theoretical or narrative evidence supporting the fact that policymakers see the debt stabilizing deficit as their target variable.

On the other hand, the debt sustainability literature analysed in the previous section provides the lagged debt as target variable based on considerations related to the sustainability of the debt dynamics. In this sense, this variable seems to us more fundamental to discriminate between passive and active fiscal regimes. At the same time, this literature has also recognised the relevance of breaks in regimes, but has mainly modelled it exogenously (for example via a dummy variable approach, or by using Quandt-Andrews likelihood ratio test to detect a breakdate in the coefficients of the estimated rule). Notable exceptions is Claeys (2008), which brings together the two approaches and estimate a MS fiscal reaction function for Sweden, but considering as target variable contemporaneous, instead of lagged, debt.

In a similar guise as Doi, Hoshi and Hokimoto (2011), who estimate (22) for Japan even if without taking into consideration the inflation variable, we try to bring together the FTPL and debt sustainability approaches by using a MS technique to estimate a Bohn type reaction function for UK, Germany and Italy. In this way we discriminate regimes where the fiscal authority is concerned with stabilizing the debt dynamics, and then reduces the primary budget deficit level in correspondence of an increase in the debt level ($\lambda < 0$), from regimes where fiscal policy aims at different objectives, e.g. output stabilization, disregarding debt stabilization ($\lambda > 0$).

The fact that fiscal policy might change stance over time induces the question on how monetary policy behaves in the same period. In particular, we wonder if monetary policy switch regime in correspondence with fiscal policy, for instance, and if it tends to be more accommodative when fiscal policy tightens and vice versa. To understand better the

macroeconomic policy mix of the countries under analysis, we estimate the monetary policy counterpart of equation (22) as follows:

$$r_t = c(S_t^M) + \beta(S_t^M)\pi_t + \gamma(S_t^M)y_t + \sigma_t(S_t^M)\omega_t \tag{23}$$

where r is the nominal policy rate, π is the inflation rate, y is the output gap, ω_t is an idiosyncratic shock to monetary policy, and S_t^M identifies the fiscal policy regime which follows a Markov chain with transition matrix P^M, whose element is $p_{ij} = \Pr[s_t = i, s_{t-1} = j]$.

Equation (23) represents a Taylor type rule (Taylor, 1993) where nominal interest rate is set by the central bank in order to stabilize inflation and the output gap. In this case we discriminate across regimes on the base of the size of the inflation parameter, β. In particular, when $\beta > 1$, we say that the monetary regime is active because it counteracts inflation on a more than one-for-one basis (i.e. the real interest rate rises when inflation rises), whereas when $\beta < 1$ the monetary regime is passive as it does not counteract inflation completely in order to satisfy the IGBC. The coefficient on the output gap is expected to be positive in order to impact counter-cyclically on the business cycle and have a stabilizing effect on the economy.

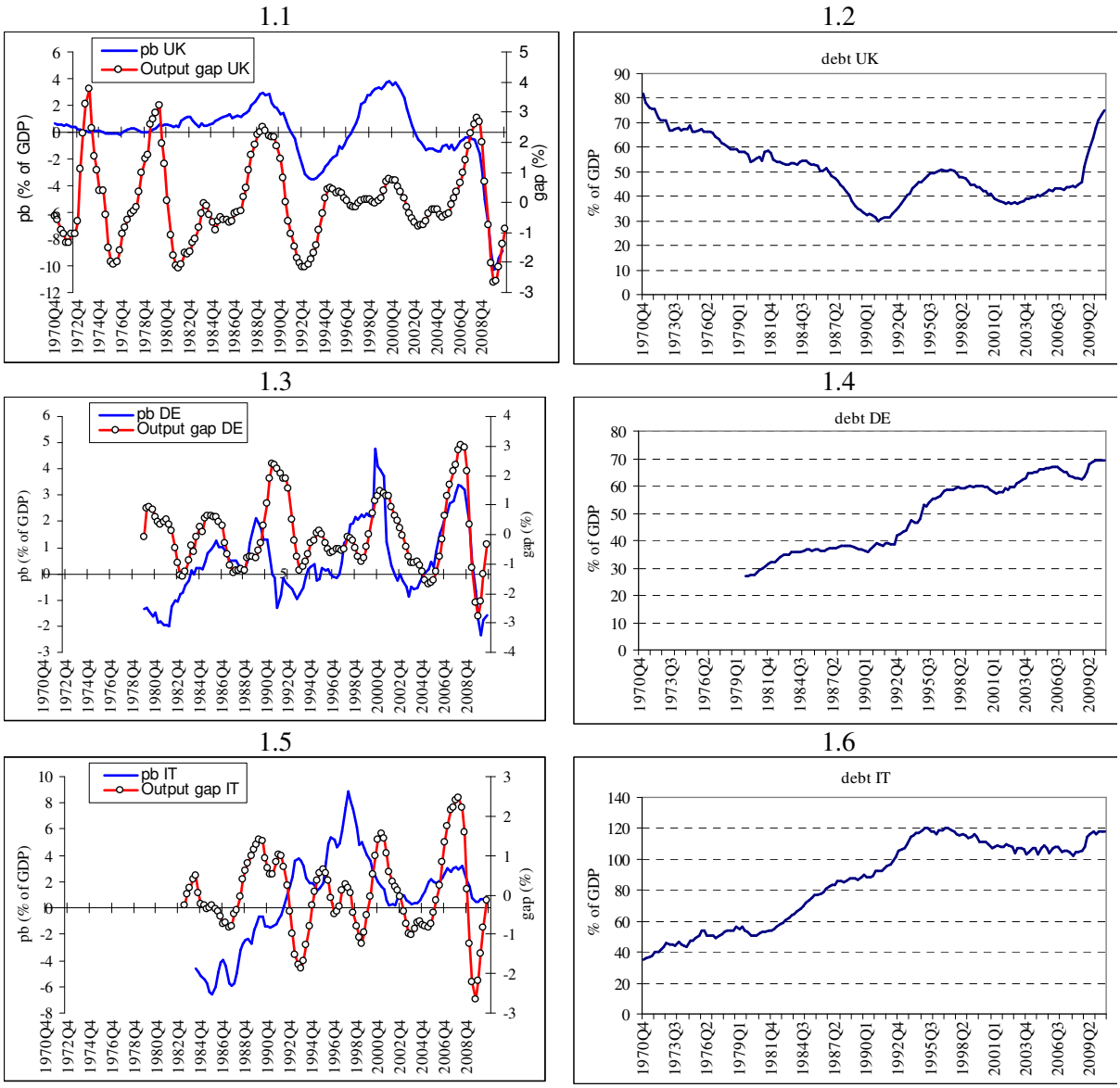
4.2. Data and stylized facts

Regarding the data we have constructed a quarterly dataset, for the U.K., Germany, and Italy, respectively for the periods, 1970:4-2010:4, 1979:4-2010:3, and 1983:Q3-2010:Q4. In this way, we test our initial theoretical assumptions for both big EU economies, for euro area and non-euro area economies, and as well for high debt and lower debt countries.

The period under analysis covers some events in the EU with relevant policy implications for the conduction of fiscal policies, notably the Maastricht Treaty of 1992, which created the European Monetary Union, together with the setting up of the fiscal criteria, and the adoption of the Stability and Growth Pact in 1997. In addition, it also covers the more recent financial and economic crisis, which roughly started in August 2007 (outbreak of the subprime crisis in the USA), followed by the 15th September of

2008 collapse of the investment bank Lehman Brothers, with the escalation of the sovereign debt crisis in the euro area.[7]

Figure 1 – Primary balance and government debt ratios



Notes: pb – primary balance ratio; debt – government debt ratio.

The choice of using quarterly data is given by the fact that, even if the budget is set annually, infra-annual discretionary adjustments are common in the implementation of fiscal policy. The detailed data sources are described in the Appendix.

Given that we wish to use quarterly fiscal data, the availability of such data is usually a restriction imposed on the analysis. Therefore, in some cases we resorted to Central Government cash data for the calculation of the quarterly primary budget balance. We then

[7] Notably the market interventions by the ECB in the form of Eurozone periphery bonds purchases that started in May 2010.

cross-checked the resulting computations with the annual numbers, which relate to the general government, and are on a national accounts basis. The main point in here is to ensure that the profile of the series is roughly similar. This seems indeed to be the case for our countries under analysis.

A simple graphical analysis shows that government debt in Germany and in Italy has essentially increased throughout the sample period, only rising in Italy at the end of the 1990s, but picking up again around 2008. In the case of the U.K., several reversals of the debt ratio can be observed notably after 1990, 1995, and 2003 (see Figure 1).

Regarding the development of the primary balance, in the U.K. again some swings are observable notably close to the economic downturn periods. On the other hand, primary balance ratios in Germany have experienced several periods of surpluses, notably in the second half of the 1980s, 1990s, and 2000s. In the case of Italy, an improvement in the primary balance occurred broadly up to 1996, after which primary surpluses starting diminishing.

4.3. Country analysis

4.3.1. United Kingdom

Fiscal rule

For the U.K., where our time span covers the period 1970:4-2010:4, we report in Table 1 the MS estimation results for the fiscal rule specified in (22) for the primary budget deficit. Notice that we have here fixed, across regimes, the coefficients for the constant and for inflation which turn out to be very similar across regimes.

From Table 1 we can see that most of the relevant parameters are statistically significant. Moreover, it is possible to observe the existence of two different responses of the primary budget deficit to debt ratio developments. In regime 1, past increases in the debt ratio lead to a passive fiscal behaviour afterwards that reduces the primary budget deficit. On the other hand, such passive behaviour is absent in regime 2 since the downward adjustment of the primary budget deficit does not take place. Still, the spending gap also pushes up the primary budget deficit in regime 1, while it is not significant in the other case.

Table 1 – (Unrestricted) Markov Switching, fiscal rule scenario with two regimes, U.K.

	c	ρ	β_2	β_1	Infl	σ_ε (x 10^2)	p	q
Regime 1	*0.0000*	-0.0258*	-0.0616	0.7410***	*0.0136*	0.0242	0.9852	
	(0.0050)	(0.0124)	(0.1196)	(0.1339)	*(0.0395)*	(0.0041)	(0.0856)	
Regime 2	*0.0000*	0.0859***	-1.1396*	-0.2779	*0.0136*	0.6567		0.9556
	(0.0050)	(0.0098)	(0.1065)	(0.1446)	*(0.0395)*	(0.0027)		(0.2400)

R^2	Logl	BIC
0.6395	445.30	-819.55

Note: standard deviations in brackets. Logl – Loglikelihood. *, **, ***, indicates significance at a 10%, 5%, and 1% level. *p* and *q* are the transition probabilities.

The effect of inflation on the budget balance would be positive when fiscal policy is being used for stabilisation purposes, or no effect if that is not a fiscal objective, as it appears to be the case in the UK (a result along the lines of Hughes Hallet, 2008).

In addition, fiscal policy seems to be a-cyclical in regime 1, the so-called passive fiscal regime, while it is counter-cyclical in regime 2. Therefore, in times of increasing output gaps or economic booms, the automatic stabilizers allow, for instance, for higher revenues and lower social transfers, which would reduce the budget deficit, and vice versa for the times of busts.

Both fiscal regimes are very persistent, as indicated by the values of the transition probabilities *p* and *q* showing, respectively, the probability that regime 1 will be followed by regime 1, and the probability that regime 2 will be followed by regime 2.

Figure 2 – Fiscal regimes, U.K.

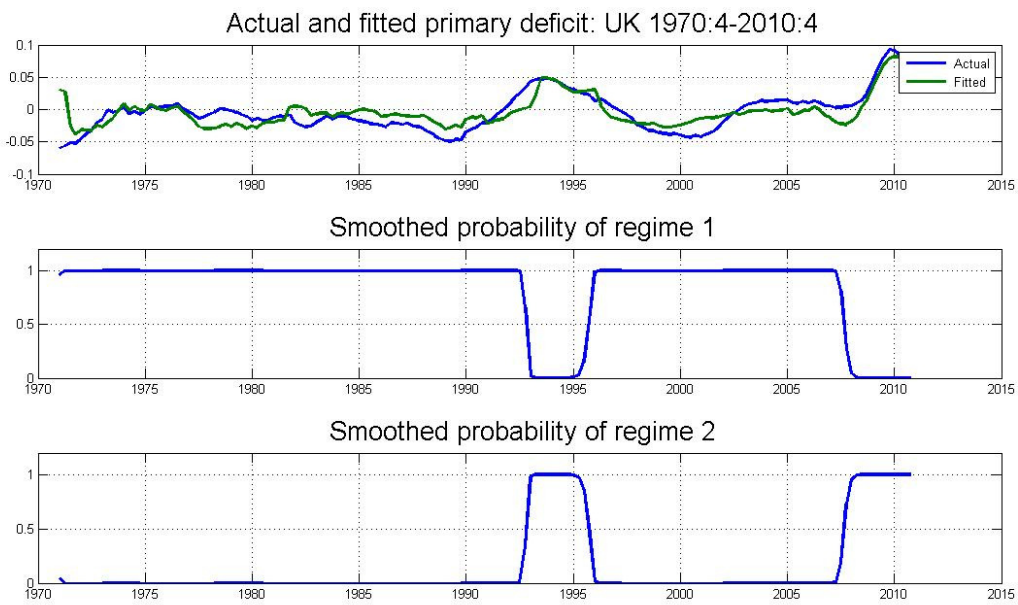


Figure 2 plots the smoothed probabilities of each fiscal regime. Therefore, we see that regime 1 predominates throughout the sample in the U.K., with the exceptions of two periods: 1993-1996 and after 2007, when fiscal policy tended to be more active.[8] According to Devries et al. (2011), in the period 1992-1996, and after the recession in the early 1990s, the size of the fiscal consolidation that took place in the U.K. was not too big in terms of its magnitude, which would not contradict a more active fiscal behaviour in that period. Along the same lines, and using alternative measures for fiscal episodes, Afonso (2010) also reports the existence of fiscal expansions in the U.K. in the period 1992-1993, followed by episodes of fiscal contraction broadly in the period 1995-1999. In addition, one can also recall that the British pound exited the Exchange Rate Mechanism on September 1992.

Regarding the switch towards a more passive fiscal policy around 1996, it is interesting to notice the move to an independent Bank of England in 1997, which may have deterred somehow more fiscal activism. The return to a less passive fiscal policy after 2007 cannot be disconnected from the impact of the 2008-2009 economic and financial crisis, notably in terms of public finances, with the sustained worsening of the primary budget deficit.

Monetary rule

We report in Table 3 and in Figure 4 the estimation results for the U.K. of the monetary reaction function (23).[9] The results show in the first regime an above unity response of the interest rate to the inflation rate in most of the period under analysis, which would imply more active monetary developments. In this case, such results can be somewhat paralleled with the abovementioned passive fiscal regime. Interestingly, with the Bohn-like fiscal rule, around the 2008-2009 economic crisis the fiscal regime shifts from passive to active while the monetary regime changes from active to passive.[10] Both regimes are particularly persistent as indicated by the transition probabilities.

[8] In this case, if one uses the more ad hoc fiscal rule of Favero and Monacelli (2005), this regime shift is uncovered for the period 1990-1994.

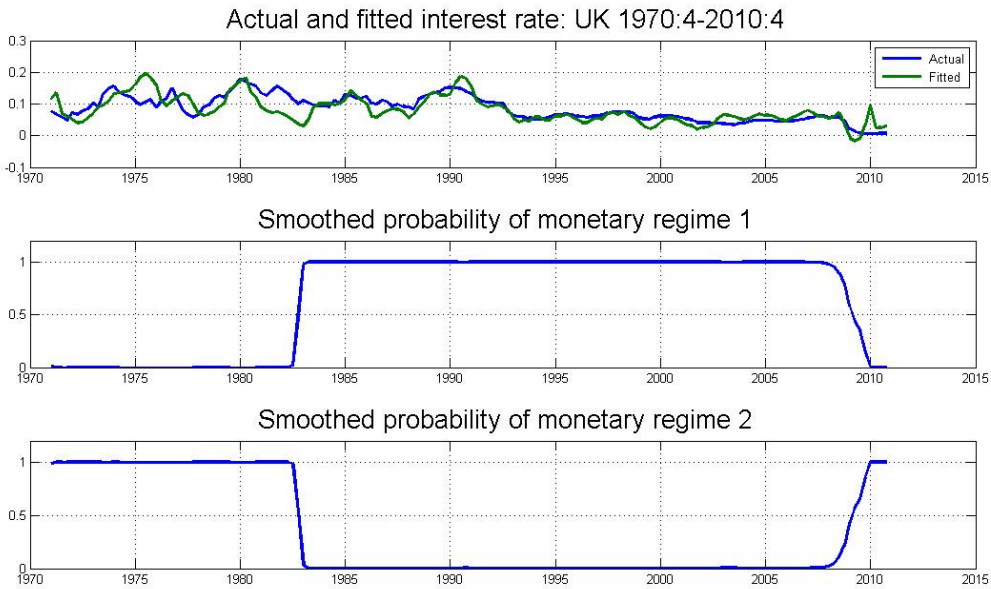
[9] We also estimated the monetary rule using instead a measure of expected inflation derived from a trivariate (interest rate, inflation, and output gap) VAR with four lags but the ensuing MS results were rather similar.

[10] The entry (October 1990) and exit (September 1992) of the U.K. into and out of the Exchange Rate Mechanism (ERM), does not seem to have played a big role int this context.

Table 3.2 – (Unrestricted) Markov Switching Scenario, monetary rule, UK

	c	β	γ	σ_ε (x 10^2)	p	q
Regime 1	*0.0000*	1.9604***	-0.9348***	0.0309	0.9902	
	(0.0042)	(0.0964)	(0.2152)	(0.0055)	(0.1071)	
Regime 2	*0.0000*	0.7540***	0.7873*	4.1162		0.9808
	(0.0042)	(0.0536)	(0.4430)	(0.0459)		(0.1407)
R^2	Logl	BIC				
0.4172	363.01	-654.98				

Figure 4 – Monetary regimes, U.K.



4.3.2. Germany

Fiscal rule

We report in Table 4 the estimation results for the baseline fiscal rule (22), inspired in Bohn (1998, 2005), for the case of Germany, with a time span that covers the period 1979:4-2010:3. Also in this case we have fixed across the two regimes the coefficients of the constant and of inflation. In addition, Figure 5 shows the probability for each of the two possible fiscal regimes in Germany.

The main conclusion relates to the fact that fiscal policy has always been, to some degree, somewhat passive, in the sense that in the both identified regimes increases in the level of government indebtedness reduced the primary budget deficit. In other words, a Ricardian fiscal behaviour would be a fair characterisation of fiscal developments in

Germany. Eventually, and if we want to differentiate somewhat across regimes, we could see regime 1 as a passive fiscal regime and regime 2 as a marginally less passive fiscal regime. Both regimes are persistent with regime 2 being slightly more so than regime 1.

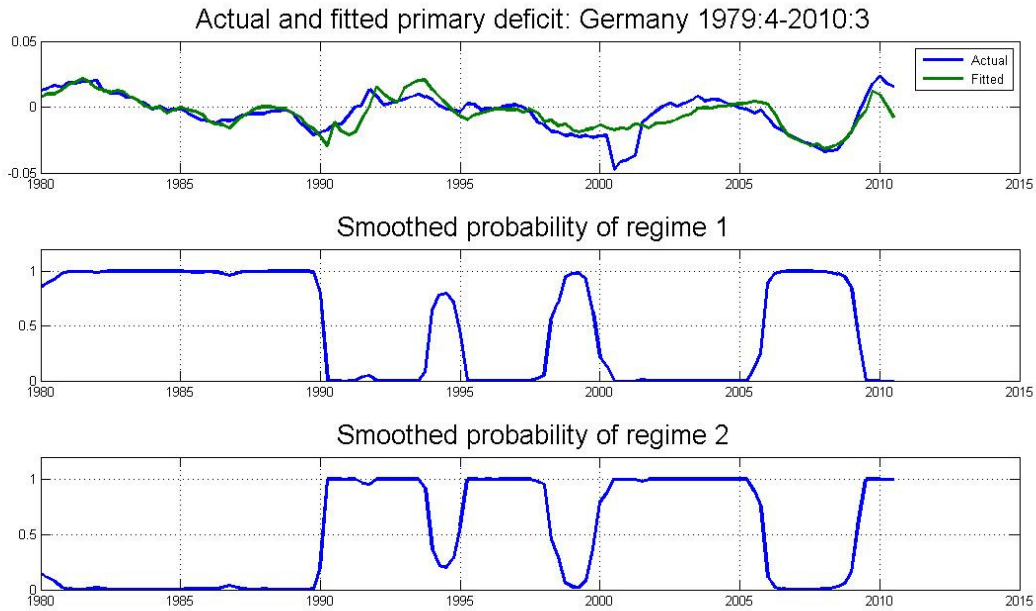
Table 4 – (Unrestricted) Markov Switching scenario with two regimes, Germany

	c	ρ	β_2	β_1	Infl	σ_ε (x 10^2)	p	q
Regime 1	*0.0000*	-0.0338***	-0.4006***	0.4528***	*0.4052****	0.0007	0.9359	
	(0.0018)	(0.0033)	(0.0388)	(0.0233)	*(0.0238)*	(0.0001)	(0.1255)	
Regime 2	*0.0000*	-0.0222***	-0.8191***	0.1714***	*0.4052****	1.0920		0.9456
	(0.0018)	(0.0040)	(0.1282)	(0.0826)	*(0.0238)*	(0.0025)		(0.1290)

R^2	Logl	BIC
0.6877	445.68	-824.00

Note: standard deviations in brackets. Logl – Loglikelihood. *, **, ***, indicates significance at a 10%, 5%, and 1% level. *p* and *q* are the transition probabilities.

Figure 5 – Fiscal regimes, Germany



Such results seem to point to the existence of a higher degree of fiscal sustainability in this case, which is consistent with the empirical evidence in the literature that usually finds Germany as a case of less unsustainable public finances.[11]

Moreover, and although fiscal policy is counter-cyclical in both regimes, the effect of the output gap has a higher absolute effect on the reduction of the primary budget deficit in

[11] See, for instance, Afonso (2005), and Bajo-Rubio et al. (2009).

the second regime, the less passive one. Furthermore, this fiscal regime seems to pick up such periods as the one following the German reunification, after 1990-1991; the 2002-2003 economic slowdown, prompting the Ecofin Council to declare an Excessive Deficit Procedure against Germany in January 2003 (notably following tax cuts that were implemented at the beginning of 2001);[12] and finally the 2008-2009 financial and economic crisis with the worsening of German public finances, (also encompassing two economic stimulus packages, in November 2008 and in January 2009), following a rather balanced budgetary position in 2007.[13]

Monetary rule

In terms of the monetary developments (Table 5 and Figure 6), both identified regimes uncover a positive reaction of the short-term interest rate to the inflation rate, exhibiting regime 2 a more active feature in this regard and a slightly inferior persistency.

Table 5.2– (Unrestricted) Markov Switching Scenario, monetary rule, Germany

	c	β	γ	σ_ε (x 10^2)	p	q
Regime 1	*0.0000*	1.7756***	0.1598*	0.0094	0.9720	
	(0.0022)	(0.0702)	(0.0952)	(0.0020)	(0.1156)	
Regime 2	*0.0000*	2.6313***	-0.1966	2.2124		0.9444
	(0.0022)	(0.3921)	(0.6039)	(0.0102)		(0.1598)

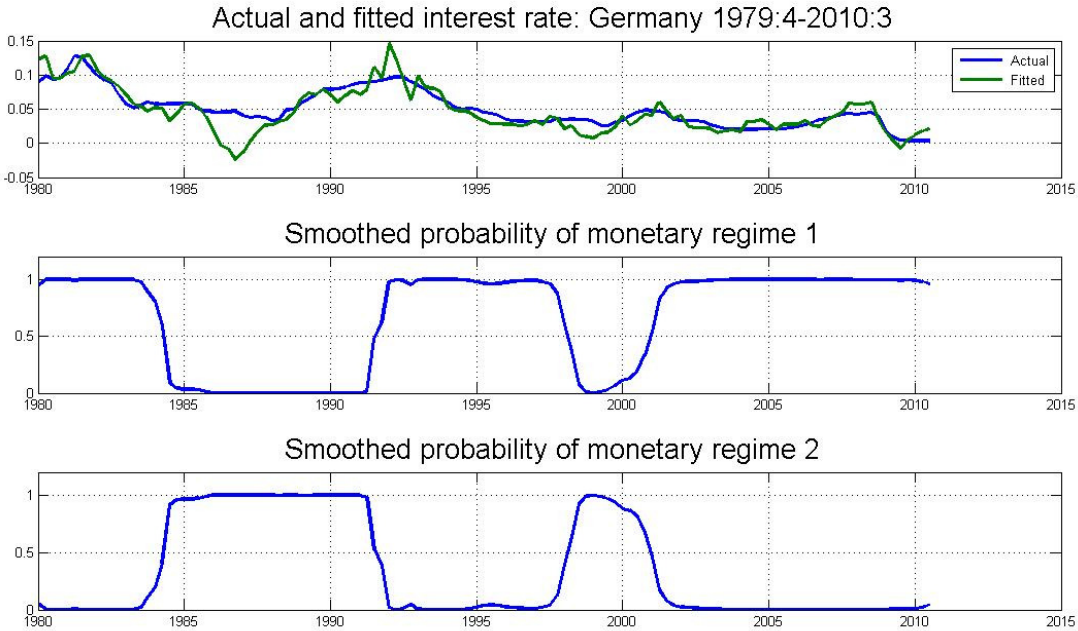
R^2	Logl	BIC
0.6509	347.48	-627.59

Note: standard deviations in brackets. Logl – Loglikelihood. *, **, ***, indicates significance at a 10%, 5%, and 1% level. *p* and *q* are the transition probabilities.

[12] See Deutsche Bundesbank (2003) for more details. In addition the debt ratio also increased in that period, in spite of the proceeds in 2000 from the auction of UMTS (Universal mobile telecommunications system) licences (51 billion euro, 2.5% of GDP) used to repay government debt.

[13] We also tried to estimate a fiscal revenue rule, following Davig and Leeper (2007), but in this case, and although revenues do respond positively to government debt increases, it is not possible to distinguish two different fiscal regimes.

Figure 6 – Monetary regimes, Germany



Interestingly, a period where monetary developments appear to be more active, the period 1998-2001 (see regime 2 in Figure 6) seem to be matched with a fiscal regime that is also more passive (see regime 1 in Figure 5).

Moreover, also the period up to 1990, where a more passive fiscal regime was in place, encompasses broadly the 1984-1991 period when the monetary poly regime was more active, with a stronger upward response of short-term interest rates to rising inflation.[14]

4.3.3. Italy

Fiscal rule

We present in Table 6 and in Figure 7 the estimation results for the primary budget deficit fiscal rule (22) for the case of Italy, covering the period 1983:3-2010:4. As before, for the cases of the U.K. and of Germany, the estimated coefficients for the constant and for inflation are fixed between the two regimes.

For Italy, regime 1 is what we can label as a passive fiscal regime since the primary budget deficit is reduced after a previous increase in the debt ratio. Interestingly, in that regime there is a-cyclicality vis-à-vis the business cycle as proxied by the output gap. As in the case of Germany, also for Italy inflation puts upward pressure on the primary budget

[14] More prescisely, the regime shift in 1985, is also uncovered by Assenmacher-Wacher (2006), who uses nevertheless a teim smaple that ends in 1998:4.

deficit, again revealing that fiscal developments worsen with price rise. Regime 1 is slightly less persistent than regime 2, as indicated by the transition probabilities.

Regarding the uncovered fiscal regimes, Figure 7 shows that the passive fiscal regime is detected around the period 1990-2000, and afterwards a switch occurs. For instance, one can mention that fiscal consolidation efforts were undertaken in Italy starting broadly in 1991, and more consistently in 1991-1995, and lasted until 1997-1998 (helped by rising primary budget balance ratios roughly up to 1997-1998).[15] Such developments also need to be seen as being especially motivated by the need to decrease the budget deficit in order to meet in 1998 the budget deficit Maastricht criterion of 3% of GDP.[16]

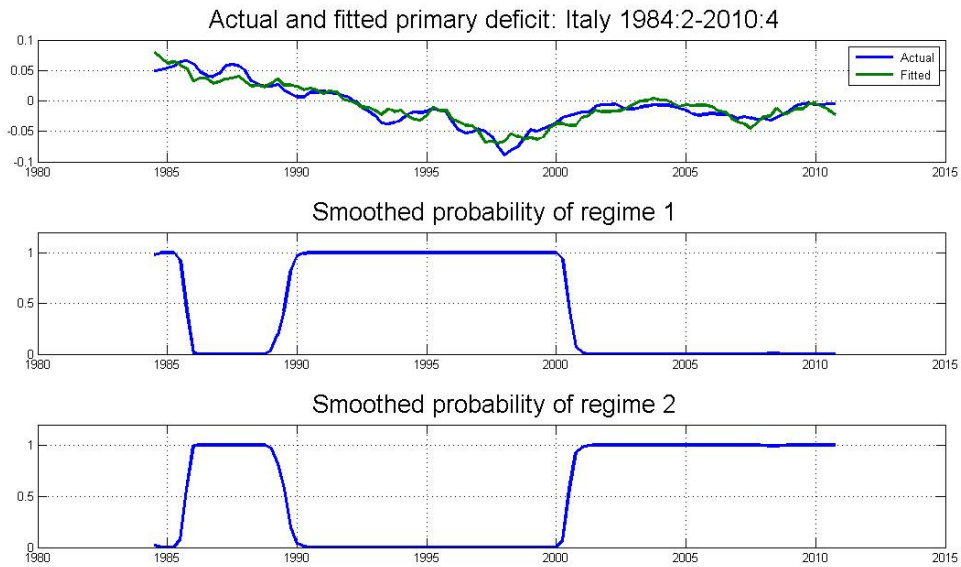
Table 6 – (Unrestricted) Markov Switching scenario with two regimes, Italy

	c	ρ	β_2	β_1	Infl	σ_ε (x 10^2)	p	q
Regime 1	*0.0000*	-0.0683***	-0.2440	0.1198***	*1.1452****	0.0115	0.9591	
	(0.0260)	(0.0199)	(0.1949)	(0.0357)	*(0.1321)*	(0.0026)	(0.1446)	
Regime 2	*0.0000*	-0.0348	-1.1132*	0.0838***	*1.1452****	1.0107		0.9815
	(0.0260)	(0.0220)	(0.1349)	(0.0393)	*(0.1321)*	(0.0028)		(0.1393)

R^2	Logl	BIC
0.8827	320.22	-575.15

Note: standard deviations in brackets. Logl – Loglikelihood. *, **, ***, indicates significance at a 10%, 5%, and 1% level. *p* and *q* are the transition probabilities.

Figure 7 – Fiscal regimes, Italy



[15] See notably Banca d'Italia (1998).

[16] One can also recall that 1997 saw the adoption of the Stability and Growth Pact, which specified and expanded the fiscal policy regulations for the European Union contained in the Maastricht Treaty of 1992.

Although, after 2000, it seems that fiscal activism was more prominent, as depicted by the switch to regime 2, with decreasing primary balances and the debt ratio stabilizing at a high level, and rising up again in the end of the sample in the aftermath of the 2008-2009 economic and financial crisis. In that period, fiscal consolidation periods delivered only mitigated fiscal relief (see notably Devries et al., 2011).

Monetary rule

Regarding the monetary reaction function for Italy (see Table 8 and Figure 9) the results show a strong positive response of the short-term interest rate to increases in inflation, which is true in both identified regimes. The magnitude of such response is higher in the second regime, which stops roughly around 1998, indicating that monetary conditions were then made less in face of the economic recovery at the time.

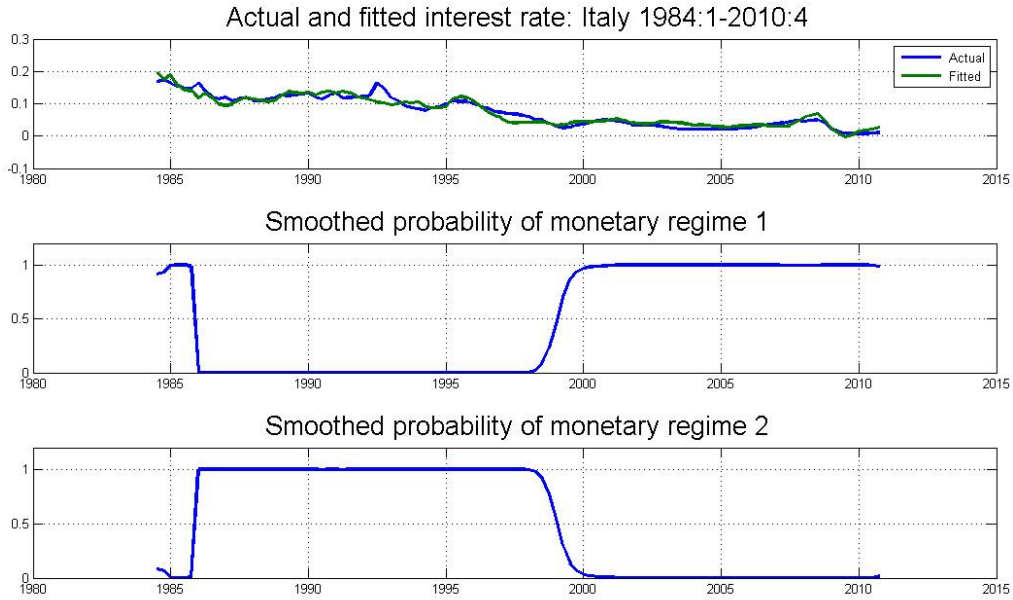
Interestingly, a less active monetary regime, regime 1 in this case, which comes into place around 1999, is then accompanied by the implementation, essentially around 2000, of a more active behaviour in terms of fiscal developments (as can be seen from Figure 7 and Figure 9). Transition probabilities show that both regimes are very persistent since the probability that regime 1 is followed by regime 1 0.9799 and the probability that regime 2 is followed by regime 2 is 0.979.

Table 8.2 – (Unrestricted) Markov Switching Scenario with two regimes, monetary rule, Italy

	c	β	γ	σ_ε (x 10^2)	p	q
Regime 1	*0.0000*	1.5616 ***	0.3011**	0.0108	0.9799	
	(0.0032)	(0.0653)	(0.1257)	(0.0036)	(0.1705)	
Regime 2	*0.0000*	2.1771***	-0.4110	1.6283		0.9790
	(0.0032)	(0.0752)	(0.3186)	(0.0044)		(0.1365)
R^2	Logl	BIC				
0.9080	298.32	-531.35				

Note: standard deviations in brackets. Logl – Loglikelihood. *, **, ***, indicates significance at a 10%, 5%, and 1% level. *p* and *q* are the transition probabilities.

Figure 9 – Monetary regimes, Italy



5. Conclusion

In this paper we estimated fiscal regime shifts for three major European Union countries (the U. K., Germany, and Italy), using a newly built quarterly data set. Moreover, we try to avoid the ad-hoc character of many existing fiscal rules, and use fiscal rules that stem from the possibility of fiscal sustainability (see Bohn, 1998, 2008), which are then estimated within a Markov switching framework. In addition, some insights are also recovered from the estimation of Taylor-type monetary policy rules for the three countries, in an attempt to cross-check the existence of fiscal activism periods coupled with either active or passive monetary policy developments.

Our main results show the existence of fiscal regimes shifts, sometimes coupled with regime switches also regarding monetary developments. For instance, in the U.K., active and passive fiscal regimes are clearer cut, notably regarding the periods 1992-1996 and after 2007, when fiscal policy tended to be more active. In Germany fiscal regimes have been overall more passive, providing some confirmation and support of more sustainable fiscal developments in this country throughout the sample period (1979:4-2010:3). Finally, for the case of Italy, a more passive fiscal behaviour can only be uncovered in the run-up to the EMU, and broadly covering the period 1990-2000. In addition, a less active monetary regime, starting around 1999, is accompanied by the implementation, after 2000, of a more active behaviour in terms of fiscal developments.

Appendix – data sources

United Kingdom

Nominal GDP: IMF IFS (IFS.Q.112.9.9B.B$C.Z.F.$$$), rolling sum of 4 quarters to calculate annual GDP.

GDP deflator: IMF IFS (IFS.Q.112.9.9B.BIR.Z.F.$$$).

Interest rate: end of quarter Sterling interbank lending rate, 1 month, average; Bank of England, series IUQVNEA.

Government debt: Since 2000 Quarterly Government Debt (Maastricht Debt) for General Government, Eurostat; older data from other sources, merged using growth values in overlapping periods (Public sector debt, National Statistics, series BKQK; Quarterly amounts outstanding of General Government sterling and all foreign currency consolidated gross debt total (in sterling millions), Bank of England, series DPQG004).

Short-term interest rate: end of quarter Sterling interbank lending rate, 1 month, mean. BoE. IUQVNEA.

Inflation rate: IMF IFS (IFS.Q.112.6.64.$$X.Z.F.$$$).

Germany

Nominal GDP: Federal Statistical Office, DeStatis, National Accounts, Gross Domestic Product since 1970, Quarterly and Annual Data. The time series before the German Unification was rescaled to the post-unification period using growth rates of quarterly data that overlap in 1991. The GDP deflator was calculated as the ratio of nominal and real GDP (available as index of 2000=100 only), rescalled to the post unification period using quarterly growth rates as well.

Interest rate: Money market rates reported by Frankfurt banks, monthly average of overnight money.

Government debt: Statistische Angaben: Umrechnungsart: Endstand, Euro, Millionen, Bundesbank. Series BQ1710, BQ1720, central, state and local government debt, total debt (excluding hospitals).

Government spending, revenue, and interest payments: General government budgetary position total spending and revenue for Germany as a whole (excluding hospitals with commercial accounting practices, excluding supplementary pension funds for public sector employees).

Short-term interest rate: Money market rates reported by Frankfurt banks / One-month funds / Monthly average (Bundesbank, SU0104).

Inflation rate: IMF IFS (IFS.Q.134.6.64.D.Z.F.$$$).

Italy

Nominal GDP: OECD (OEO.Q.ITA.GDP); GDP deflator: IMF IFS (OEO.Q.ITA.PGDP).

Interest rate: money market rate, IMF IFS.

Government debt: General Government debt, Banca d'Italia.

Government spending, revenue, interest payments: Ministry of Finance, ISTAT.

Short-term interest rate: money market rate, IMF IFS; OECD, OEO.Q.ITA.IRS.

Inflation rate: IMF IFS (IFS.Q.136.6.64.$$$.Z.F.$$$).

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